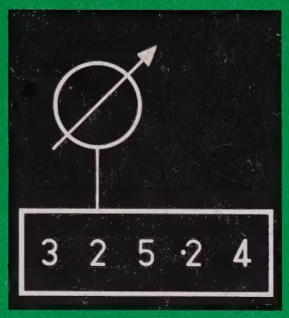
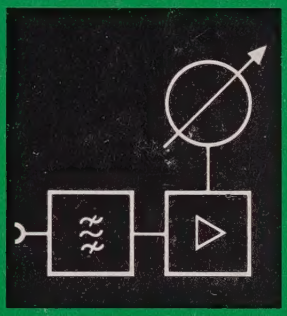
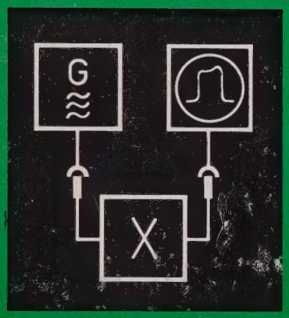
CAL TRAM
"A"







WIDEBAND VOLTMETER (VTVM)

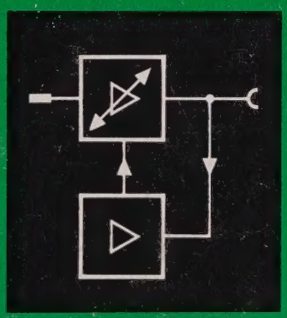
SM-2

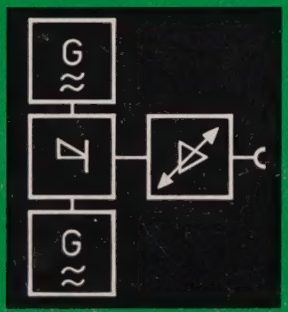
2 cps to 1 mc

(0.1) 1 mv to 300 volts; (-80) - 60 db to +50 db

Description 128 B

November 1962





MP MASTER
MA29294

WANDEL u. GOLTERMANN
REUTLINGEN / GERMANY

Digitized by the Internet Archive
in 2025

https://archive.org/details/manualsplus_06424

INSTRUCTIONS FOR OPERATION

WIDEBAND VOLTMETER

2 cps to 1 mc

(0.1) 1 mv to 300 volts

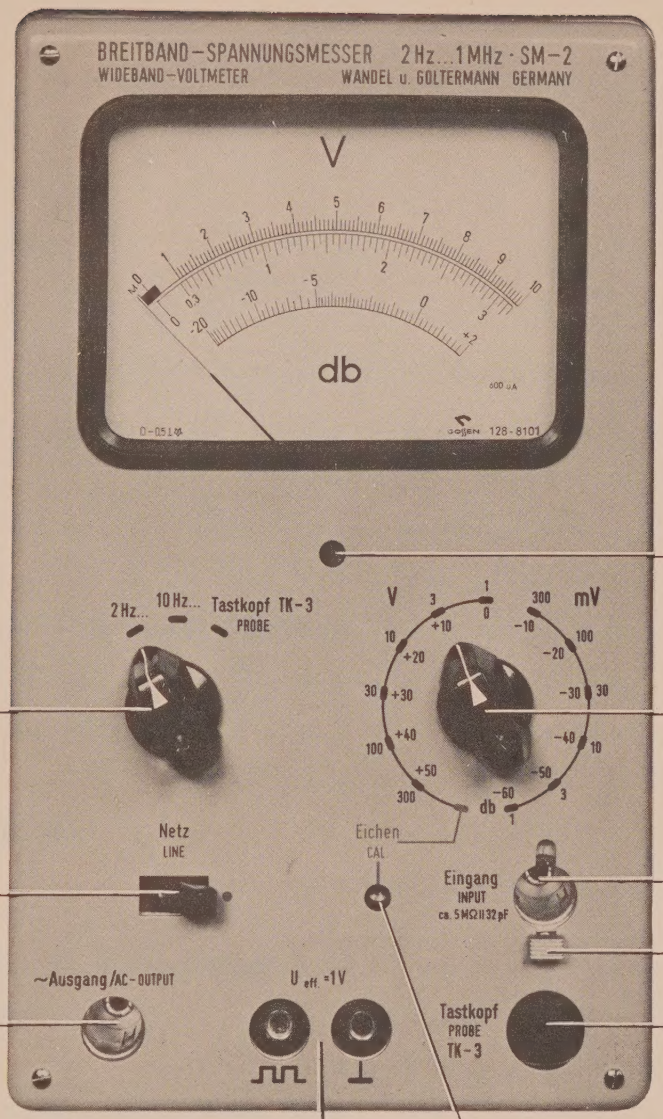
(-80) -60 db to +50 db

SM-2 Description 128 B

November 1962

WANDEL u. GOLTERMANN · REUTLINGEN · GERMANY

0,07.12.62.1049 Printed in Western Germany



MECHANICAL NEUTRAL POINT

MODE SWITCH S 102

RANGE SWITCH S 101

ON-OFF SWITCH S 301

INPUT JACK Bu 101

SHIELD SLIDE

AC OUTPUT JACK Bu 203

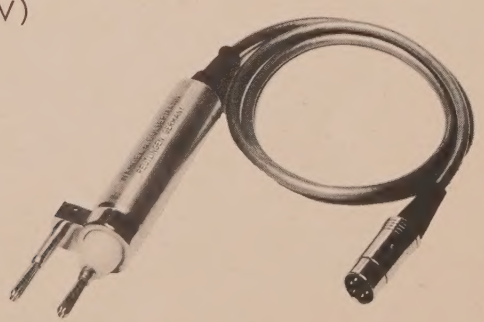
PROBE TK-3 INPUT JACK Bu 301

CALIBRATION VOLTAGE OUTPUT JACK Bu 102

(E_{rms} = 1 V)

CALIBRATION POTENTIOMETER P 201

PROBE TK-2



PROBE TK-3

CONTENTS

Ratings 4

Voltage ranges 7

General 8

Constructional Details and Mode of Operation 9

Input Divider 9

Probe TK-2 9

Probe TK-3 10

Preamplifier 11

Mode Switch and Lower Cutoff Frequency 11

Voltage Range Divider 11

Reading Amplifier and Rectifier 12

Output Jacks 12

Calibration Oscillator 13

Power Supply 13

Instructions for Operation 14

Power Connection 14

Calibration 14

Checking and Calibrating the Probe TK-3 15

Checking and Calibrating the Probe TK-2 15

Input Impedance 16

Connection of Recording Means 16

Operation as an Amplifier 17

Remarks on Tube Replacement 17

RATINGS

Operation without Probe

Frequency range	2 cps to 2 mc
Measuring range, full-scale	1 mv to 300 volts -58 to +52 db
Twelve subranges	see Table on page 7
Lowest voltage measurable	0.1 mv or -80 db
Accuracy [1] in frequency range 1 to 6 kc after calibration, full-scale	± 1 % or better
Frequency response of reading, ref. to 1 kc, max.	± 2 %
Input impedances	
at 2 cps to 100 kc, ranges 1 to 300 mv	2 MΩ
ranges 1 to 300 volts	7.5 MΩ
at 1 mc, ranges 1 to 300 mv	0.5 MΩ
ranges 1 to 300 volts	1 MΩ
Input capacitance	32 pf

Operation with Probe TK-3

Frequency range	10 cps to 1 mc
Measuring range, full-scale	1 mv to 3 volts -58 db to +12 db
Eight subranges	see Table on page 7
Lowest voltage measurable	0.1 mv or -80 db
Accuracy with probe TK-3 at 6 kc after calibration, full-scale	± 1,5 % or better
Input impedances at frequencies 10 cps to 100 kc	20 MΩ
at 1 mc	1 MΩ
Input capacitance	7 pf

[1] See page 6

Temperature Effect [1]

Effect of ambient temperature fluctuation between 0° and +40°C on meter reading, without recalibration, max. . . . . $\pm 5 \times 10^{-4}$ per °C

Effect of ambient temperature fluctuation between +18 and +28°C on voltage of calibration oscillator, max. . . . . $\pm 3 \times 10^{-4}$ per °C

Additional meter scale inaccuracy and nonlinearity of output values at ambient temperatures from 0 to +40°C, ref. to full scale, max. . . . . ± 0.1 %

Tube complement of SM-2	ECL 82, Stv 85/8, 6 x EF 800
TK-3	5718
Supply voltage required 45 to 60 cps	110, 115, 220, or 240 v ± 10 %
Power consumption	50 watts
Width x Height x Depth	160 x 275 x 340 mm
Weight	7 kg

[1] Accuracies and effects of interferences are checked separately and are therefore separately indicated. In practical operation, however, the individual tolerances are not fully applicable, or they add statistically with different signs so that the overall accuracy after calibration does not exceed the value ± 1.5 % in all measuring ranges at 1 to 6 kc, in the scale arc portion from 30 to 100 %, at ambient temperatures between +18 to +28°C, and supply voltage fluctuations of ± 5 %.

Right of modification reserved

VOLTAGE RANGES

Position of switch S 101		Signal voltage into SM-2 for full defl. on SM-2		Signal voltage into TK-3 for full defl. on SM-2		Signal voltage into TK-2 for full defl. on SM-2	
1	mv	1	mv	1	mv	10	mv
3	mv	3	mv	3	mv	30	mv
10	mv	10	mv	10	mv	100	mv
30	mv	30	mv	30	mv	300	mv
100	mv	100	mv	100	mv	1	v
300	mv	300	mv	300	mv	3	v
1	v	1	v	1	v	10	v
3	v	3	v	3	v	30	v
10	v	10	v	-		100	v
30	v	30	v	-		300	v
100	v	100	v	-		-	
300	v	300	v	-		-	

Position of switch S 101		Signal voltage into SM-2 for full defl. on SM-2		Signal voltage into TK-3 for full defl. on SM-2		Signal voltage into TK-2 for full defl. on SM-2	
- 60	db	- 58	db	- 58	db	- 38	db
- 50	db	- 48	db	- 48	db	- 28	db
- 40	db	- 38	db	- 38	db	- 18	db
- 30	db	- 28	db	- 28	db	- 8	db
- 20	db	- 18	db	- 18	db	+ 2	db
- 10	db	- 8	db	- 8	db	+ 12	db
0	db	+ 2	db	+ 2	db	+ 22	db
+ 10	db	+ 12	db	+ 12	db	+ 32	db
+ 20	db	+ 22	db	-		+ 42	db
+ 30	db	+ 32	db	-		+ 52	db
+ 40	db	+ 42	db	-		-	
+ 50	db	+ 52	db	-		-	

Frequency range	SM-2	SM-2 and TK-3	SM-2 and TK-2
	2 cps to 1 mc	10 cps to 1 mc	5 kc to 1 mc

GENERAL

The Wideband Voltmeter SM-2 is a precision instrument for alternating voltages 0.1 mv to 300 volts in the frequency range 2 cps to 1 mc. The set operates with mean-value rectification. The scale is calibrated in both volts and db, the level of 0 db corresponding to a voltage of 0.775 volts in 600 ohms.

The input impedance is about 2 to 7.5 MΩ, depending on the subrange. At the upper frequency limit (at 1 mc), it is reduced to about 0.5 to 1 MΩ.

The input is unbalanced.

The illuminated meter scale has an arc length of 90 mm for safe and reliable reading.

The signal voltage to be measured may be directly fed to the Voltmeter SM-2; on the other hand, a probe may be connected between the measurand and the Voltmeter SM-2.

The Probe TK-2 is a capacitive divider with an input capacitance of about 14 pf. The probe permits to measure points that would be loaded with a too high capacitance if cords with prongs were used. The signal voltage is divided by the ratio 10 : 1 in the Probe TK-2; voltages can be measured in the range 10 mv to 300 volts (full-scale deflection) in the frequency range 5 kc to 1 mc.

The Probe TK-3 is an impedance converter for measurements from low voltages at points of high resistance. Its input impedance amounts to 20 MΩ II 7 pf. This probe permits to measure voltages up to 3 volts in the frequency range 10 cps to 1 mc.

CONSTRUCTIONAL DETAILS AND MODE OF OPERATION

The Wideband Voltmeter comprises
one input divider, ratio 1000 : 1, for the ranges 1 to 300 volts,
one three-stage preamplifier,
one range divider providing subranges within the ranges 1 mv to 300 mv and 1 v to 300 v,
one three-stage reading amplifier,
one metering rectifier for mean-value operation,
one meter,
one calibration oscillator, and
one power supply with electronic regulation.

Input Divider

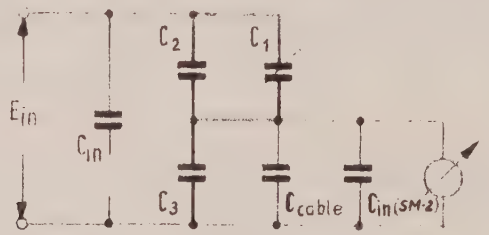
In the voltage ranges 1 to 300 volts, the input voltage is attenuated by the factor 1000 by the voltage-dividing attenuator R 102, R 103, P 101. To avoid excursions of the frequencyresponse characteristic, the attenuator is equalized for high frequencies with the capacitors C 103, C 104. The potentiometer P 101 serves to re-align the resistors R 102, R 103, thus counteracting the effects of aging, if any. The trimmer capacitor C 101 is provided to adjust the same input capacitance between the two ranges 1 - 300 millivolts and volts, respectively. This is of importance when the Voltmeter operates together with the capacitive probe TK-2.

Probe TK-2

The Probe TK-2 is a capacitive divider having an input capacitance of 14 pf and a divider factor of exactly 10.
The equivalent circuit diagram - see block diagram attached - indicates the method of voltage attenuation. Excursions of the input impedance to the Voltmeter SM-2 would make impossible an accurate voltage division; therefore, the trimmer capacitor C 101 is provided so that alignment to the same capacitance in all subranges is facilitated.

The Probe TK-2 is calibrated with the aid of the trimmer capacitor C 1.

Since the probe is connected to the normal input of the Voltmeter, but divides the signal voltage by 10, the range switch inscriptions on the S 101 do not apply to measurements in which the probe TK-2 is employed. The factor 10 corresponds to two sensitivity steps of the range switch (see Table page 7).



Voltage attenuation by Probe TK-2

Probe TK-3

This probe is an impedance converter having a small input capacitance and a large input resistance. It contains a grounded-plate tube stage and transmits the signal voltage 1 : 1.

The Wideband Voltmeter SM-2 has an extra 6-point jack for connection of the Probe TK-3 and for heater and plate supply to the latter.

To avoid external voltages that might interfere with the probe operation, a slide uncovering the probe jack automatically shields the normal input jack of the SM-2.

For operation with the Probe TK-3 it is necessary to place the mode switch S 102 into the position PROBE where the plate voltage, additionally filtered by R 302, C 303. becomes applied to the probe. In this switch position, a frequency-response equalizing network R 227, R 228, C 209 is switched on at the same time.

To preclude erroneous measurements when the probe is pulled out of the jack Bu 301 and yet the mode switch is left in the PROBE position when signal voltage is applied to the normal input jack of the SM-2, the input-stage tube of the Voltmeter SM-2 is cut off from the heater-power source by the pulled probe. This heater power is thus applied to the input stage only when the mode switch is in position 1 or 2.

Preamplifier (see Circuit Diagram 1)

The preamplifier is fed by voltage from the divider S 101/I and S 101/II and will therefore process voltages between 0.1 mv and 300 mv. Of its three stages, the third stage operates with grounded plate. Resistor R 124 provides negative feedback over all three stages. The trimmer capacitor C 113, parallel-connected to R 124, equalizes the frequency response at upper frequencies.

Mode Switch and Lower Cutoff Frequency (see Circuit Diagrams 1 and 2)

The mode switch S 102 has three positions marked 2 cps, 10 cps and PROBE TK-3. The latter position has been explained above. In position 2 cps, an additional charging capacitor C 210 becomes connected to the rectifier of the reading amplifier. Without this capacitor, the meter needle would oscillate with the low input frequency and give no unambiguous reading. However, this capacitor should be switched off for frequencies greater than 10 cps so that the needle can rapidly come to a standstill.

Switch S 102, when positioned to 2 cps, connects not only the needle-damping capacitor C 210, but also extends the lower cutoff frequency range of the reading amplifier. For this purpose, S 102/I connects a large coupling capacitor C 118 between the preamplifier and the reading amplifier (see Circuit Diagram 1). In the mode switch position 10 cps, the cutoff frequency is increased because otherwise low-frequency components of the flicker effect of the input tube and surges of the supply voltage would cause additional needle oscillations.

Measuring Range Divider (see Circuit Diagram 2)

The overall range (input voltages 0.1 mv to 300 volts) is divided in the preamplifier input circuit into two large ranges. The range switch S 101/III provides six subranges of each of the two ranges. Owing to the low resistance of the subrange divider, the preamplifier comprises a cathode output stage.

Capacitor C 201 provides equalization of the frequency response.

Reading Amplifier and Rectifier (see Circuit Diagram 2)

Three pentode stages form the reading amplifier. Degenerative feedback from the third to the first stage provides linear amplification, the trimmer capacitor C 206 aids in correction of the frequency response. The rectifier is coupled to the plate of the last tube. The junction rectifier measures the mean values of the two half-waves of the alternating voltage applied to the input. Resistor R 226 and the series-connected potentiometer P 201 are parallel to the meter. P 201 is operated to adjust the overall sensitivity of the set.

When the mode switch S 102 is in position PROBE TK-3, the resistor R 229 and the potentiometer P 202 become connected. This provides additional alignment of the overall sensitivity for probe operation.

A current of 13.2 µA flows through resistor R 231 and potentiometer P 203. This current is derived from the plate direct voltage and linearizes the reading in the scale range from 10 to 100 per cent to a residual error of 0.5 per cent or less. It is the cause of the difference between the electrical and the mechanical neutral point of the meter. The potentiometer P 203 can be used to calibrate the electrical neutral point; it is accessible at the rear wall of the Voltmeter SM-2.

Silicon diode Gl 203 is parallel connected to the meter and protects the latter against overloading.

The meter current flowing at full-scale deflection through the meter and resistors R 232 or R 235, R 236, R 237 is 600 µA.

Output Jacks

The jack Bu 201 provides a no-load direct voltage of 1 volt with an internal resistance of 4.66 kilohm, provided that the meter needle is fully deflected. A recorder may be connected to this jack. However, the recorder should have a ground-free input because jack Bu 201 is on the potential of the plate voltage (galvanic coupling to the plate of the last amplifier tube).

The switching jack Bu 202 may be used to connect a recorder having an input resistance of 200 ohms; when it is used, the 200-ohms resistor R 236 becomes switched-off automatically. A current of 300 µA will flow through the recorder if the meter needle points to "3" of the lower volts scale (corresponding to 95 % of the full-scale value).

Jack Bu 203 is the AC output of the Voltmeter SM-2. It is directly connected to the cathode resistor of the last tube. This direct coupling permits to connect a device via a capacitor suitable for the case. It should be noted that a direct voltage of 1.8 volt appears across jack Bu 203. Even where the DC component does not interfere, a low-resistance device connected to Bu 203 may shift the operating point of the tube Ro 203 and thus cause a wrong reading; in such cases, DC decoupling should be used.

Calibration Oscillator (see Circuit Diagram 1)

The Voltmeter SM-2 has a 6-kc square-wave oscillator having a constant output amplitude. The output square-wave voltage has an rms value of 1 volt and is available from the pair of jacks Bu 102, front panel.

The push-pull calibration oscillator has a frequency determined by the resonant circuit L 101-C 112. The oscillator transistors T 102-T 103 are so overloaded that the output voltage has a square waveform. This waveform is applied via a buffer stage T 101 to the calibration-voltage output. The supply voltage of the buffer stage is stabilized by a Zener diode Gl 101. This arrangement stabilizes the output amplitude.

The temperature coefficients of transistor 101 and the silicon zener diode Gl 101 have a mutually cancelling effect as they are mounted in a common metal block and are exposed to the same temperature.

An aligning potentiometer P 102 is series-connected to the output divider network R 105, R 106, R 107 and may be used to adjust the calibration voltage.

Power Supply (see Circuit Diagram 3)

The plate voltage of all amplifier tubes is electronics stabilized by a regulation circuit which simultaneously keeps the interference level at a low value. The input tube Ro 101 and the tube of the Probe TK-3 are heated by direct current.

INSTRUCTIONS FOR OPERATION

Power Connections

Connect the Wideband Voltmeter SM-2 to a power line 220 V 45 to 60 cps. Resolder the power transformer leads for operation from 110, 115, or 240 volts AC (Fig. 3). In this case, make sure the proper fuse rating is used : 0.3 amps slow-acting for 220 and 240 volts, 0.6 amps slow-acting for 110 and 115 v.

The Voltmeter design is based on German standards. The cabinet and the shield of the input jack are not connected to protective-ground leads, thus excluding interference over uncontrollable ground connections that would make difficult to measure low voltages.
However, protect yourself against wrong connections in the measurand. Connect the Voltmeter to protective ground if the no-load signal voltage exceeds 65 volts and the short-circuit current exceeds 5 milliamps. For this purpose, a terminal is provided on the rear side of the Voltmeter.

Switch the set on, allow for a warm-up period of a few minutes. The warranted ratings are reliably ensured after 30 minutes, the full calibration oscillator accuracy after two hours of warm-up.

Calibration

The calibration procedure here described primarily serves to check the functions of the Voltmeter. You will rarely have to operate the adjusting potentiometers; therefore, they are made for screwdriver operation. The danger of erroneous measuring due to unintended change of the adjustments is much nearer than errors due to aging.

Switch the set off and make sure the meter needle points to the mechanical zero (left hand range of the scale). If necessary, readjust with the aid of the screw MECHANICAL NEUTRAL POINT provided on the front panel.

Switch the set on, adjust range switch S 101 to 300 V, do not apply any signal voltage. Position the mode switch S 102 to 10 cps. After the warm-up time, the needle should point to the electrical neutral point.

If it does not, correct with the aid of control P 203.

Frequent excursion of the electrical zero would point to a failure of C 210 or C 211 (too high leakage current).
Position switch S 101 to CALibration. Now the needle should be deflected to the full-scale position. If necessary, correct with calibration control P 201 on the front panel.

Checking and Calibrating the Probe TK-3

Calibrate the Voltmeter SM-2 first. Connect the Probe TK-3. Position the mode switch S 102 to PROBE TK-3. Allow for the warm-up time (one minute will do if the voltmeter had been switched on before).
Adjust the range switch S 101 to 1 V. Plug the probe head into the calibration-oscillator output jack Bu 102 (the right-hand jack is grounded). Now the meter needle should be full-scale deflected to 10 in the upper scale (volts). Correct with the control P 202 if necessary.

Checking and Calibrating the Probe TK-2

Calibrate the Voltmeter SM-2 first. Connect the Probe TK-2 to jack Bu 101. Adjust the range switch S 101 to 100 mV. Plug the probe head into the left-hand one of the two calibration-voltage jacks Bu 102. The meter needle should now point to 10 in the upper volts scale (full-scale deflection). If this is not the case, readjust by trimmer capacitor C 1 of the probe.

Input Impedance

The values of the input impedance associated with various switch positions and frequency ranges are given under RATINGS in this manual. Generally the effective impedance will decrease at frequencies above 50 to 100 kc because of the then increasing dielectric loss of circuit capacitances and insulating materials. On the other hand, the negative feedback of preamplifier or probe may cause the impedance to increase. However, no negative impedance will occur : This is prevented, for instance, by the resistor R 109 and careful exclusion of any stray capacitance.

Connection of Recording Means

A digital measuring set or a compensation recorder may be connected to jack Bu 201. This jack provides an output voltage of 1 volt from a circuit having an internal resistance of 4.66 ohms; this voltage is indicated by a full-scale deflection of the SM-2 meter needle. Examples of devices that can be connected to this output jack are the analog-to-digital voltage converters ADW-1 or ADW-2 permitting recording of measurements.

A three-pole plug as used for magnetic tape recorders may be used for jack Bu 201.

ATTENTION :

The jack Bu 201 is connected to the plate voltage 70 volts against ground. Before connecting a recorder or converter, make sure its input circuit is not grounded.

A recorder having an input resistance of 200 ohms may be connected to the output jack Bu 202 of the Voltmeter SM-2. If the input resistance of the recorder is accurate to ± 1 %, the needle deflection to "3" on the lower volts scale will indicate the flow of a current of 300 µA.
Jack Bu 202 is a switching jack. Use a plug Type T stv 13 d (Siemens & Halske).

ATTENTION : Jack Bu 202 is connected to a plate voltage 70 volts against ground. Make sure the recorder input circuit is not grounded before connecting the recorder to the Voltmeter SM-2. A suitable recorder type is the MULTAVI SCHREIBER made by Hartmann and Braun.
As long as no input signal is applied to the SM-2, a bias current will flow through the jack Bu 202. This current amounts to 6.6 microamps in the case of Series A Voltmeters

with a load resistance of 100 ohms; it is 6.95 microamps with Series B Voltmeters with load resistance of 200 ohms.

Operation as an Amplifier

The amplified alternating voltage is available from jack Bu 203. When the needle is fully deflected, this output voltage is 0.4 volt approximately. The amplification factor is about 500 in the subrange 1 mv when the output is terminated with at least 10 kilohms (max. 100 pf). If the load is less, the meter reading may be inaccurate; if it is greater, the frequency response will be affected.

ATTENTION:
Jack Bu 203 is directly connected to the cathode of the tube Ro 203 and, hence, to a direct voltage of 1.8 V. If this is undesirable, connect a suitable capacitor to the jack to obtain pure alternating voltage.

Remarks on Tube Replacement

A mu-metal cap shields the tube Ro 101. It serves to keep interfering voltages due to production spread within tolerable limits. When replacing a tube, make sure the shielding cap is placed on the correct tube.
The long-life tubes EF 800 used in the Wideband Voltmeter SM-2 may be substituted by the radio-grade type EF 80. The latter have ratings that are less strictly limited; hence, the frequency response of the Voltmeter may be slightly affected.

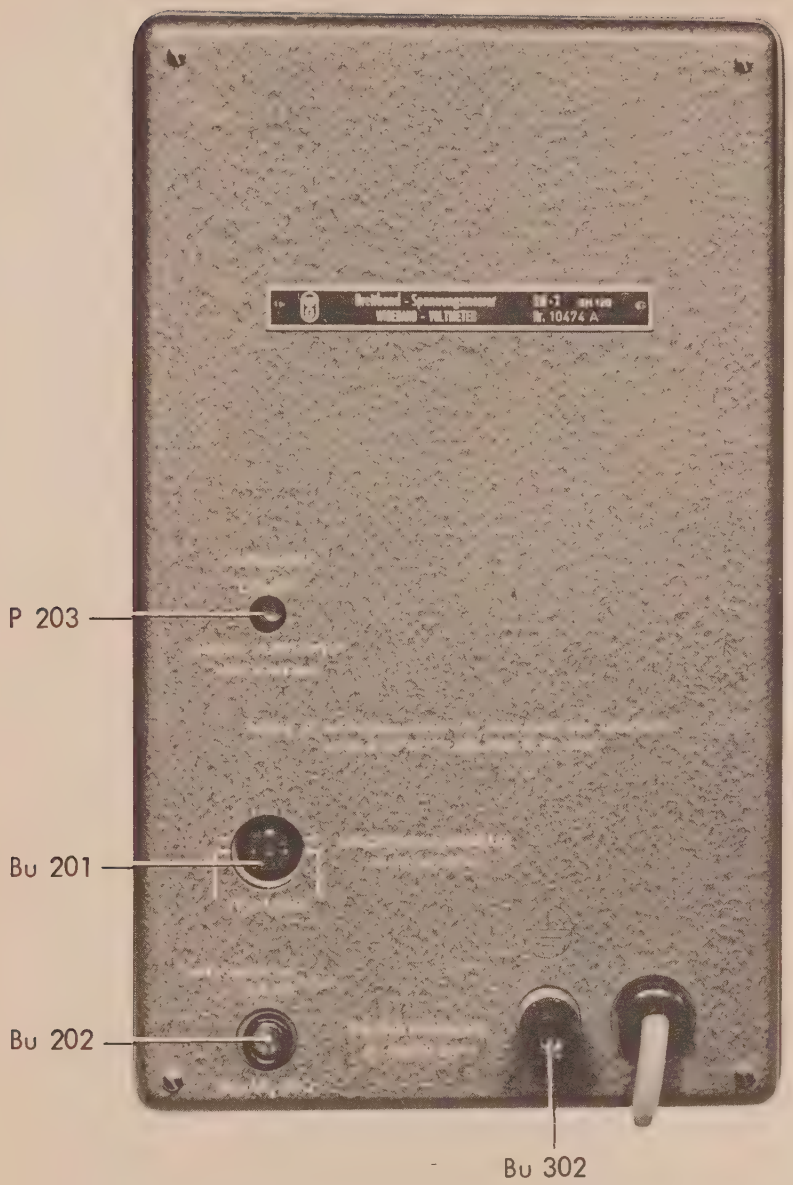
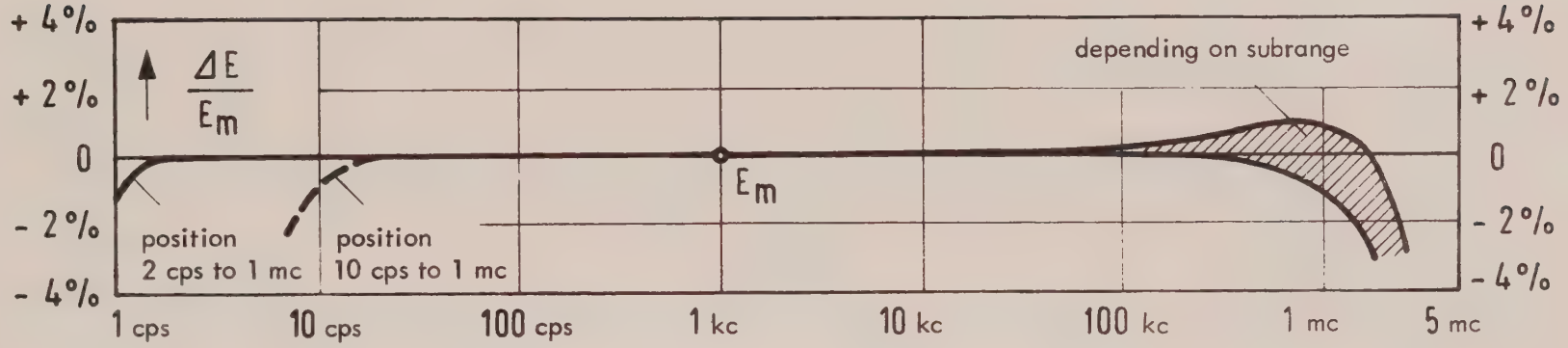
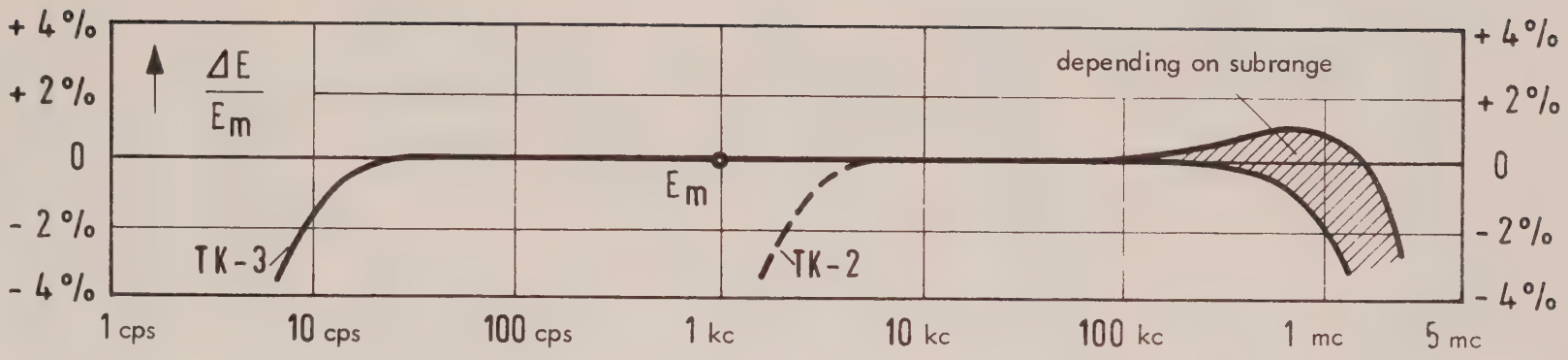


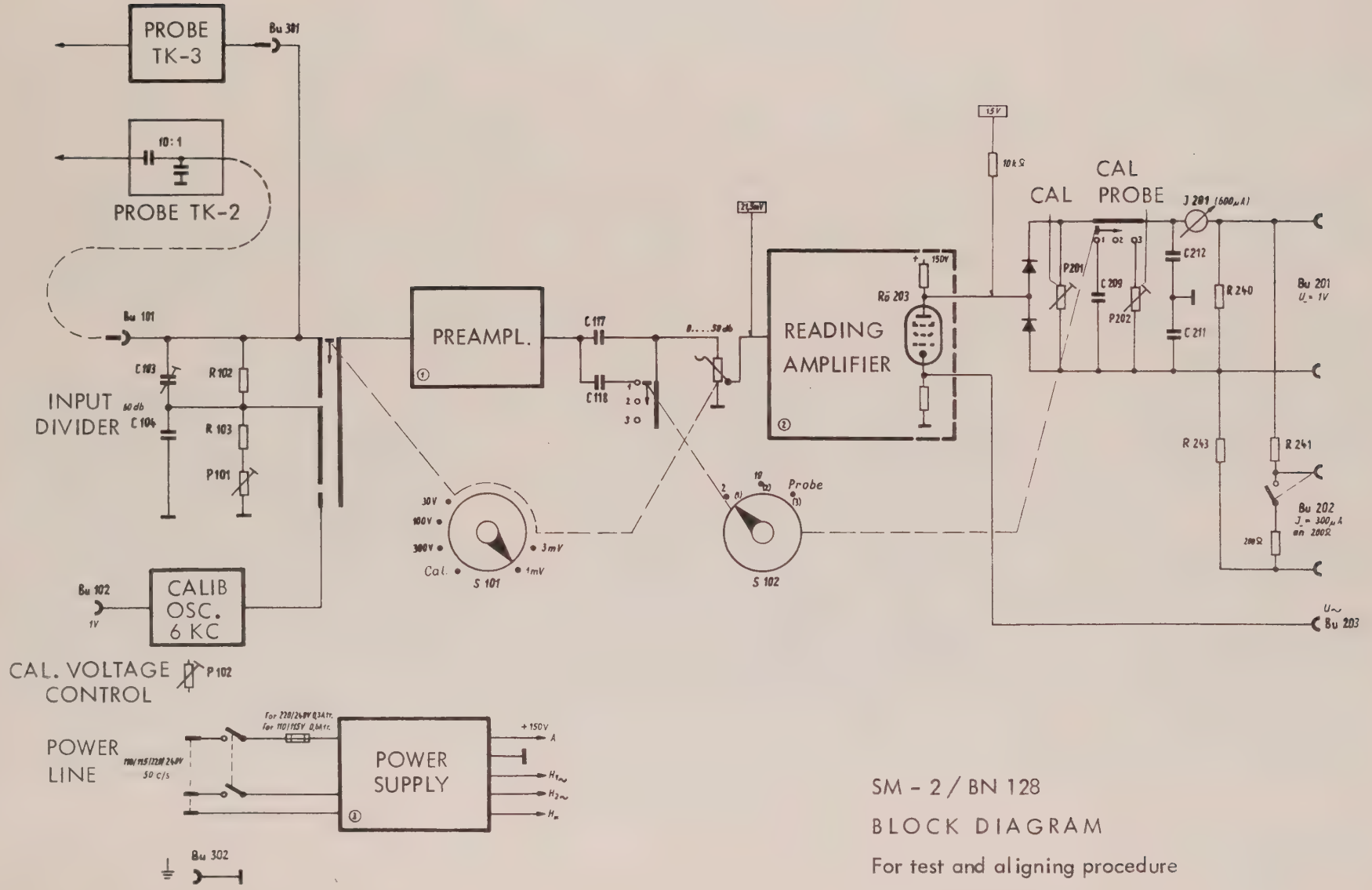
Fig. 2 REAR VIEW OF THE VOLTMETER SM-2

FREQUENCY RESPONSE OF THE READING SM-2



FREQUENCY RESPONSE OF THE READING WHEN PROBE TK-2 OR TK-3 IS USED





SM - 2 / BN 128

BLOCK DIAGRAM

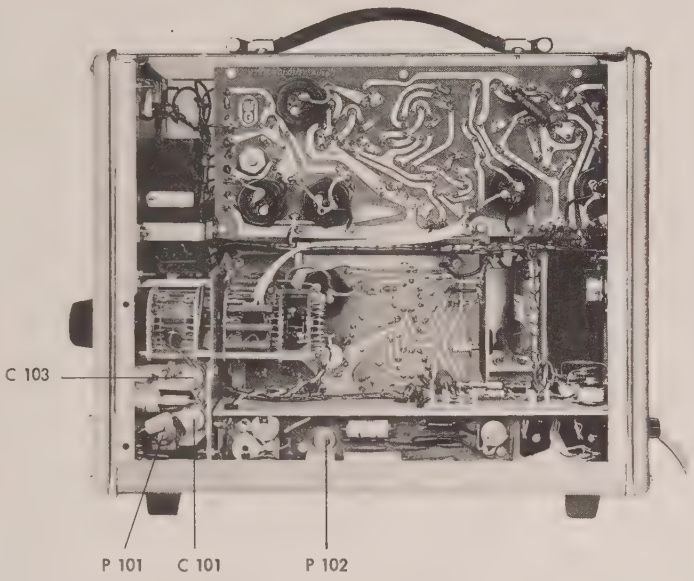
For test and aligning procedure

No.	Testing of :	x feed to • measure	Rating x open • parallel	Frequency	Internal resistance of signal voltage or meter	Switch positions S 101	 S 102	P 201	P 202	Result expected or remark
1	Reading circuit	Plate of tube 203	x 15 V	1 kc	10 kΩ		2	fully turned on		full-scale reading expected
2	Reading amplifier	x input reading amplifier	• 21,5 mV	1 kc	ca. 0 Ω	3 mV	2	fully turned on		full-scale reading expected
3	Preamplifier (overall gain, normal operation)	x Bu 101	• 0,89 mV	1 kc	≦ 10 kΩ	1 mV	2	fully turned on		full-scale reading expected
4	Probe TK-3 (overall gain with probe)	x Probe TK-3	• 0,86 mV	1 kc	≦ 10 kΩ	1 mV	3	fully turned on	fully turned on	full-scale reading expected
5 a	Calibration oscillator	x Bu 101	standard 1 V	1 kc	≦ 1 kΩ	1 V	2	adjust to red scale mark		Set should operate at least 2 h
5 b						CAL-ibration	2	ditto		needle should point to red mark (cal.)
5 c		Connect Bu 101 to Bu 102				1 V	2	ditto		needle should point to red mark ± 0.5 % of full-scale value
6	Control P 202	Probe TK-3 in Bu 102				1 V	3	calibrated	adjust to red scale mark	
7	Output Bu 201	• Bu 201	1 V 0,97 V	= =	∞ 150 kΩ	CAL-ibration	2	calibrated		Output voltage for full deflection
8	Output Bu 202	• Bu 202	316 µA	=	200 Ω	CAL-ibration	2	calibrated		Output current for full-scale defl.
9	Output Bu 203	x Bu 101 • Bu 203	1 V 0,57 V	1 kc 1 kc	≧ 10 kΩ	1 V 1 V	2 2			Output voltage Bu 203 full-scale

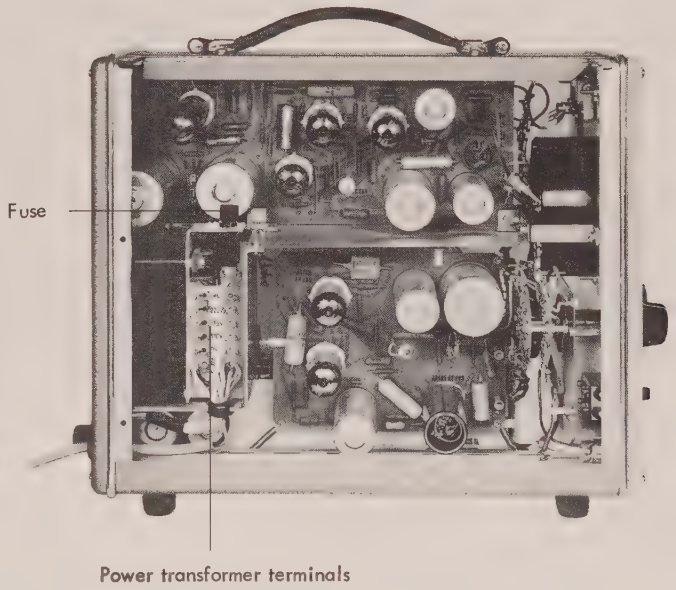
TEST PROCEDURE

Voltmeter SM-2

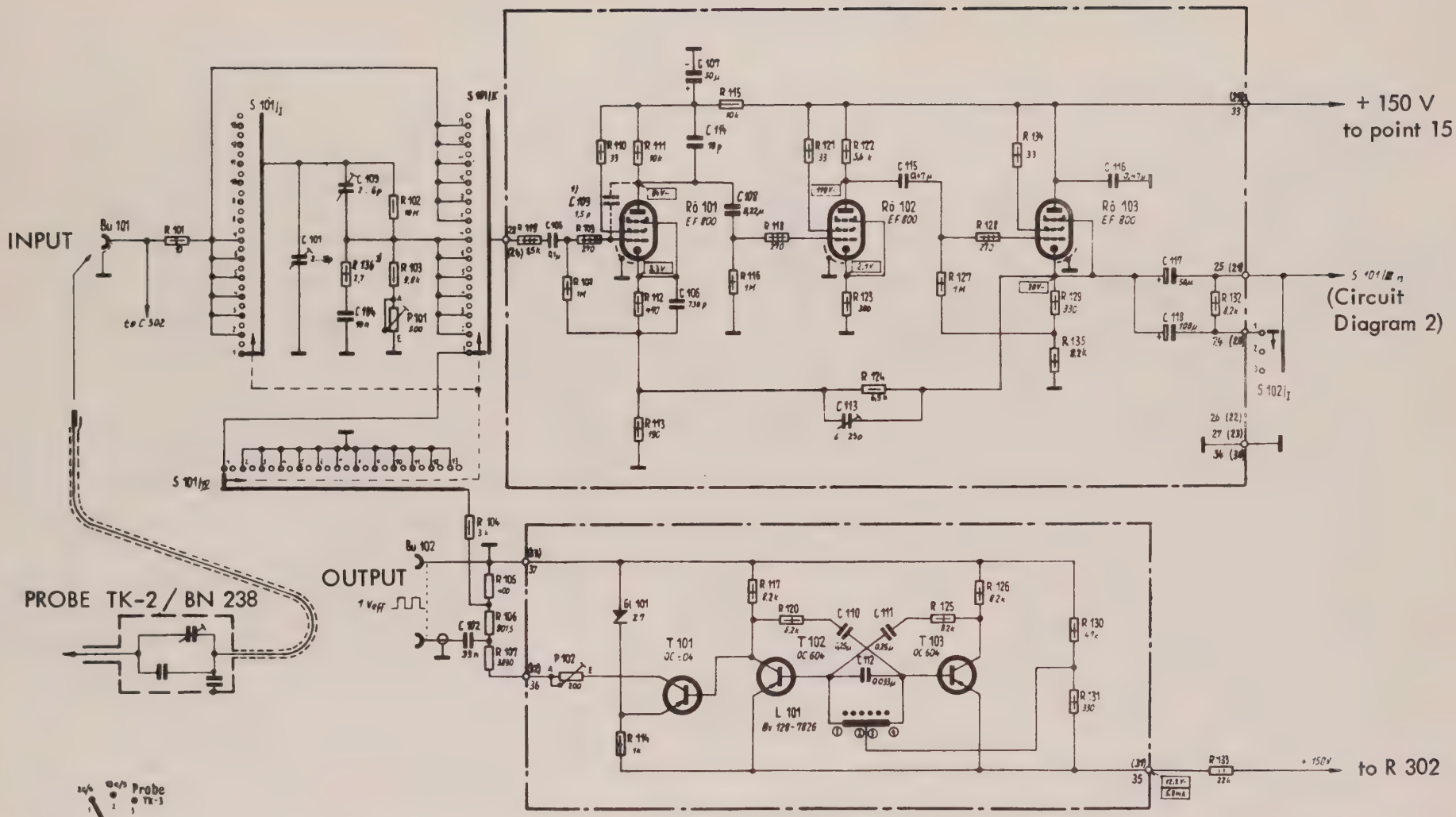
component	problem	procedure
C 103	Input divider	Connect a 60-db divider to the input of SM-2. The alignment depends on the divider accuracy. Range 3 mv. Signal frequency 30 kc. Varying the signal voltage (about 3 V), adjust meter needle to exactly coincide with one scale marking near full scale. Disconnect external divider, change to range 3 V and adjust to the same needle position by C 103.
P 101	Input divider	Connect the external divider once more. Range 3 mV. Signal frequency 300 cps. Note needle deflection adjusted. Remove external divider, switch to range 3 V, adjust to the same needle deflection by P 101.
P 102	Calibration oscillator	Allow for warm-up time 2 hrs, cabinet closed. Feed standard 1 V (1 to 6 kc) to Bu 101. Range 1 V. Adjust needle to red marking by P 201. Adjust S 101 to CALibration. Adjust meter needle to red cal. marking by P 102.



Aligning components are accessible when left-hand side cover is removed.



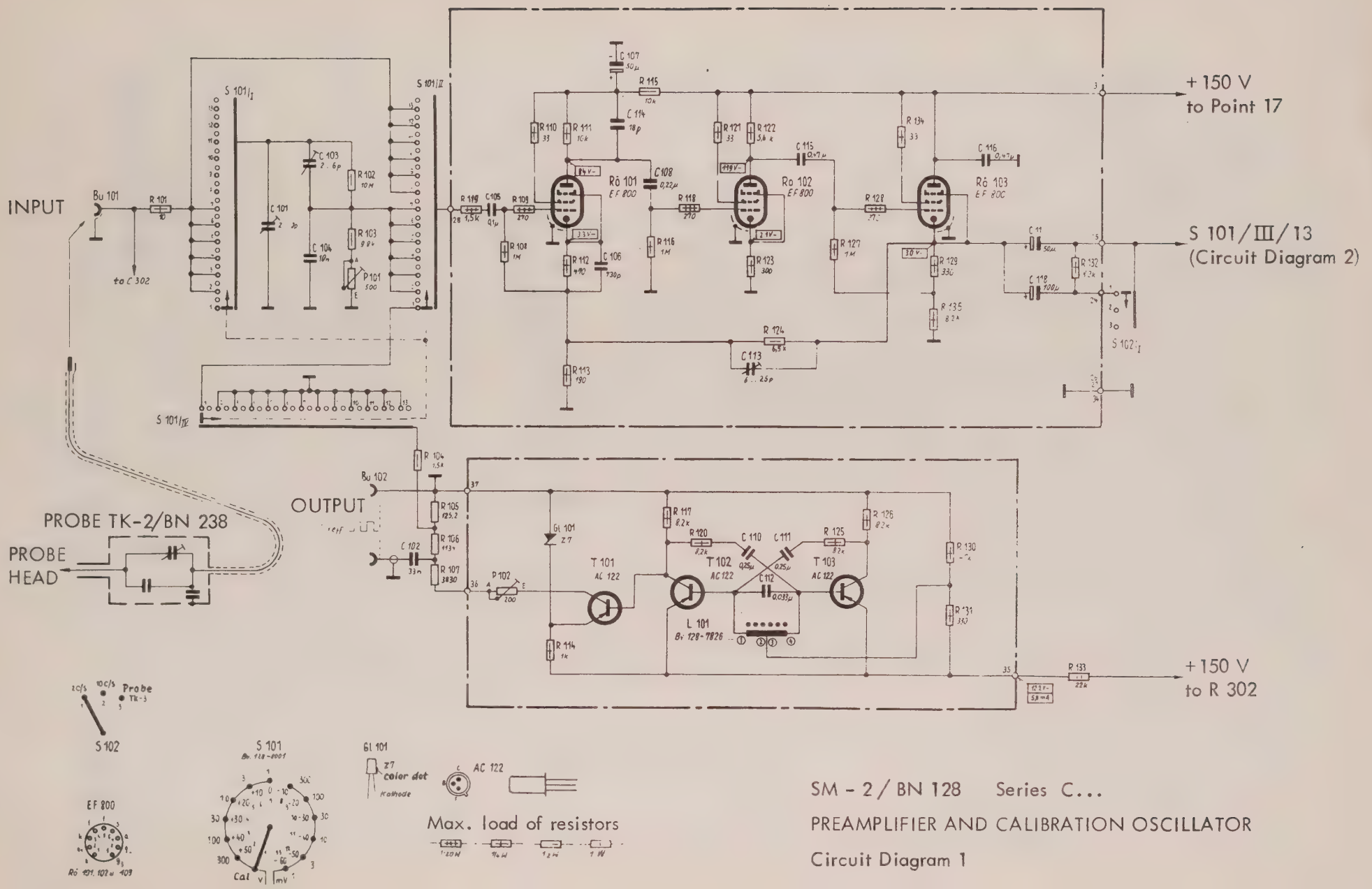
Fuse, transformer and tubes accessible when right-hand side cover is removed.



[1]) C 109 only in Series A. Figures in parentheses apply to Series A Voltmeters only.

[2]) Type b in Series A; Type 1 in Series B. [3]) R 136 not included in Series A.

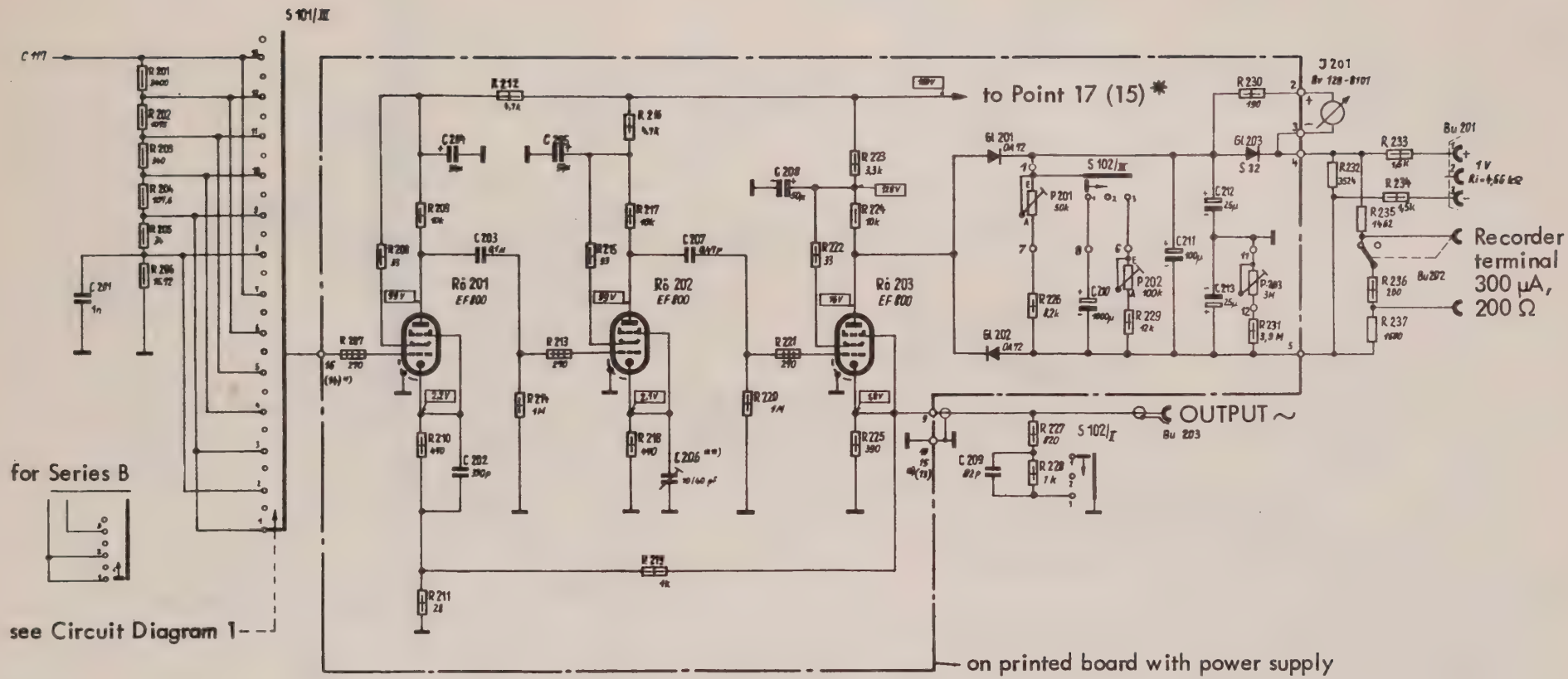
SM – 2 / BN 128 Series A and B...
PREAMPLIFIER AND CALIBRATION OSCILLATOR
Circuit Diagram 1



SM - 2 / BN 128 Series C...

PREAMPLIFIER AND CALIBRATION OSCILLATOR

Circuit Diagram 1



*) Figures in parentheses : for Series B

**) for Series B: C 206/6...25 pF

EF 800

Rö 201, 202 u. 203

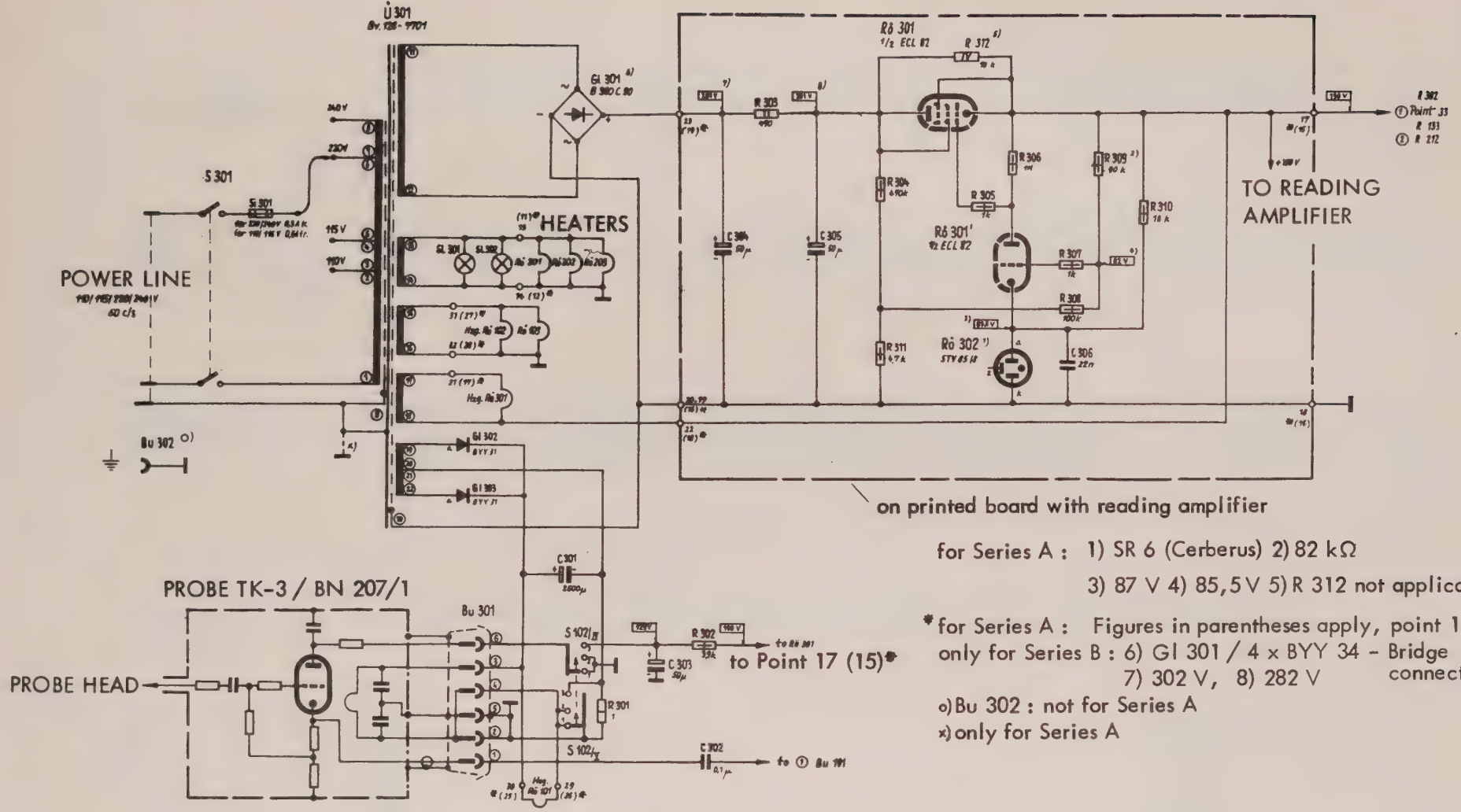
Max. load of resistors

Bu 201

SM-2/BN 128 Series B...

READING AMPLIFIER

Circuit Diagram 2



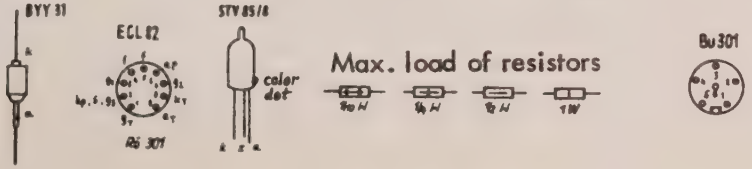
for Series A : 1) SR 6 (Cerberus) 2) 82 kΩ
3) 87 V 4) 85,5 V 5) R 312 not applicable

*for Series A : Figures in parentheses apply, point 19
only for Series B : 6) Gl 301 / 4 x BYY 34 - Bridge connection
7) 302 V, 8) 282 V

o) Bu 302 : not for Series A

×) only for Series A

①: The figure indicates the Circuit Diagram



SM-2 / BN 128 Series A...

POWER SUPPLY

Circuit Diagram 3

Widerstände, Resistors				
R 101	10 Ω	0,25 W	5 %	
R 102	10 MΩ	0,5 W	0,5 %	
R 103	9,8 kΩ	0,5 W	0,5 %	
R 104	1,5 kΩ	0,5 W	0,5 %	Serie B: 3 kΩ
R 105	125,2 Ω		0,1 %	Serie B: 400 Ω
R 106	1134 Ω		0,1 %	Serie B: 901,5 Ω
R 107	3830 Ω		0,1 %	
R 108	1 MΩ	0,25 W	5 %	
R 109	270 Ω	0,05 W	5 %	
R 110	33 Ω	0,25 W	5 %	
R 111	10 kΩ	0,25 W	5 %	
R 112	470 Ω	0,25 W	5 %	
R 113	190 Ω	0,25 W	1 %	
R 114	1 kΩ	0,25 W	5 %	
R 115	10 kΩ	0,5 W	5 %	
R 116	1 MΩ	0,25 W	5 %	
R 117	8,2 kΩ	0,25 W	5 %	
R 118	270 Ω	0,05 W	5 %	
R 119	1,5 kΩ	0,05 W	5 %	
R 120	8,2 kΩ	0,25 W	5 %	
R 121	33 Ω	0,25 W	5 %	
R 122	5,6 kΩ	0,25 W	5 %	
R 123	300 Ω	0,25 W	5 %	
R 124	6,5 kΩ	0,5 W	0,5 %	
R 125, 126	8,2 kΩ	0,25 W	5 %	
R 127	1 MΩ	0,25 W	5 %	
R 128	270 Ω	0,05 W	5 %	
R 129	330 Ω	0,25 W	5 %	
R 130	47 kΩ	0,25 W	5 %	
R 131	330 Ω	0,25 W	5 %	
R 132	8,2 kΩ	0,25 W	5 %	
R 133	22 kΩ	2 W	5 %	
R 134	33 Ω	0,25 W	5 %	
R 135	8,2 kΩ	0,25 W	5 %	
P 101	500 Ω	lin		Potentiometer
P 102	200 Ω	lin		Potentiometer
Kondensatoren, Capacitors				
C 101	2...10 pF			Trimmer
C 102	33 nF	400 V		
C 103	2...6 pF			Trimmer
C 104	10 nF	125 V	± 5 %	
C 105	0,1 µF	600 V	20 %	
C 106	730 pF	500 V	2 %	
C 107	50 µF	250 V		Elko

C 108	0,22 µF	125 V-	10 %	
C 110, 111	0,25 µF	160 V		
C 112	33 nF	250 V		
C 113	6...25 pF			Trimmer
C 114	18 pF	500 V-	2 %	
C 115	0,47 µF	125 V		
C 116	0,47 µF	300 V		
C 117	50 µF	250 V		Elko
C 118	100 µF	250 V		Elko

Röhren, Tubes

Rö 101...103	EF 800	Telefunken	

Transistoren, Diode — Transistors, Diode

T 101...103	AC 122	Telefunken	Serie B: OC 604

Zener-Diode

GI 101	7,5 V ± 2 %	b. 5 mA	Z 7	Intermetall

R 201	3400 Ω	0,5 W	0,1 %	
R 202	1075 Ω	0,5 W	0,1 %	
R 203	340 Ω	0,5 W	0,1 %	
R 204	107,6 Ω	0,5 W	0,1 %	
R 205	34 Ω	0,5 W	0,1 %	
R 206	15,72 Ω	0,5 W	0,1 %	
R 207	270 Ω	0,05 W	5 %	
R 208	33 Ω	0,25 W	5 %	
R 209	10 kΩ	0,25 W	5 %	
R 210	470 Ω	0,25 W	5 %	
R 211	28 Ω	0,25 W	1 %	
R 212	4,7 kΩ	0,25 W	5 %	
R 213	270 Ω	0,05 W	5 %	
R 214	1 MΩ	0,25 W	5 %	
R 215	33 Ω	0,25 W	5 %	
R 216	4,7 kΩ	0,25 W	5 %	
R 217	10 kΩ	0,25 W	5 %	
R 218	470 Ω	0,25 W	5 %	
R 219	1 kΩ	0,25 W	1 %	
R 220	1 MΩ	0,25 W	5 %	
R 221	270 Ω	0,05 W	5 %	
R 222	33 Ω	0,25 W	5 %	
R 223	3,3 kΩ	0,25 W	5 %	
R 224	10 kΩ	0,5 W	5 %	
R 225	390 Ω	0,25 W	5 %	
R 226	8,2 kΩ	0,25 W	5 %	
R 227	820 Ω	0,25 W	5 %	
R 228	1 kΩ	0,25 W	1 %	
R 229	12 kΩ	0,25 W	5 %	
R 230	190 Ω	0,25 W	1 %	
R 231	3,9 MΩ	0,25 W	5 %	
R 232	3524 Ω		0,1 %	
R 233, 234	1,5 kΩ	0,25 W	5 %	
R 235	1462 Ω		0,1 %	
R 236	200 Ω	0,25 W	1 %	
R 237	1500 Ω		0,1 %	
P 201	50 kΩ	lin		Potentiometer
P 202	100 kΩ	lin		Potentiometer
P 203	3 MΩ	lin		Potentiometer

Kondensatoren, Capacitors

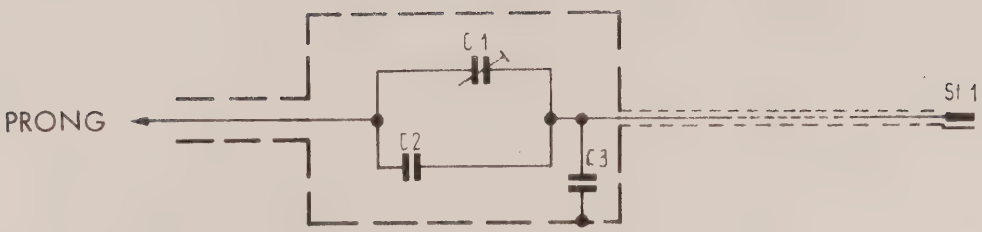
C 201	1 nF	125 V	2,5 %	
C 202	390 pF	125 V	2,5 %	
C 203	0,15 µF	125 V		
C 204, 205	50 µF	250 V		Elko
C 206	10...40 pF			Trimmer

C 207	0,47 µF	125 V		
C 208	50 µF	250 V		Elko
C 209	47 pF	500 V	2 %	
C 210	1000 µF	15 V		Elko
C 211	100 µF	6 V		Elko
C 212, 213	25 µF	350 V		Elko

Röhren, Dioden Tubes, Diodes

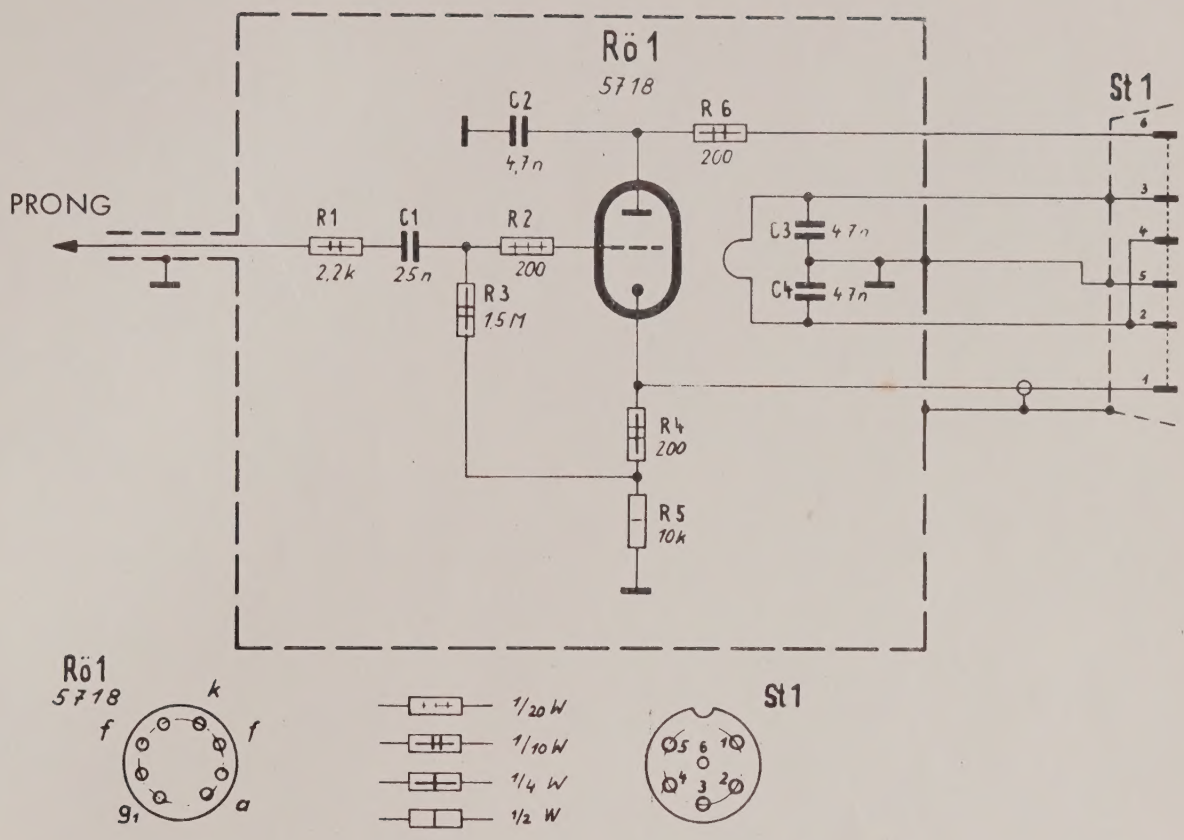
Rö 201...203	EF 800	Telefunken	
Gl 201, 202	OA 72	Valvo	Germanium-Diode
Gl 203	S 32	Intermetall	Silizium-Diode

Widerstände, Resistors				
R 301	1 Ω	1 W	5 %	
R 302	3,9 kΩ	0,25 W	5 %	
R 303	470 Ω	2 W	5 %	
R 304	470 kΩ	0,25 W	5 %	
R 305	1 kΩ	0,25 W	5 %	
R 306	1 MΩ	0,25 W	5 %	
R 307	1 kΩ	0,25 W	5 %	
R 308	100 kΩ	0,25 W	1 %	
R 309	90 kΩ	0,25 W	1 %	
R 310	18 kΩ	0,25 W	5 %	
R 311	4,7 kΩ	0,25 W	5 %	
R 312	10 kΩ	4 W		
Kondensatoren, Capacitors				
C 301	2500 µF	15/18 V		Elko
C 302	0,1 µF	125 V		
C 303	50 µF	250 V		Elko
C 304, 305	50 + 50 µF	350 V		Elko
C 306	22 nF	400 V		
Röhren, Tubes				
Rö 301	ECL 82	Telefunken		
Rö 302	STV 85/8	Telefunken		
Lampen, Sicherung		Lamps, Fuse		
SL 301, 302	6 V	3 W		Soffitenlampe
Si 301	0,3 A	träge		
Gleichrichter, Rectifier				
Gl 301	B 390 C 90			Flachgleichrichter
Gl 302, 303	BYY 31	Intermetall		Silizium-Leistungsgleichrichte



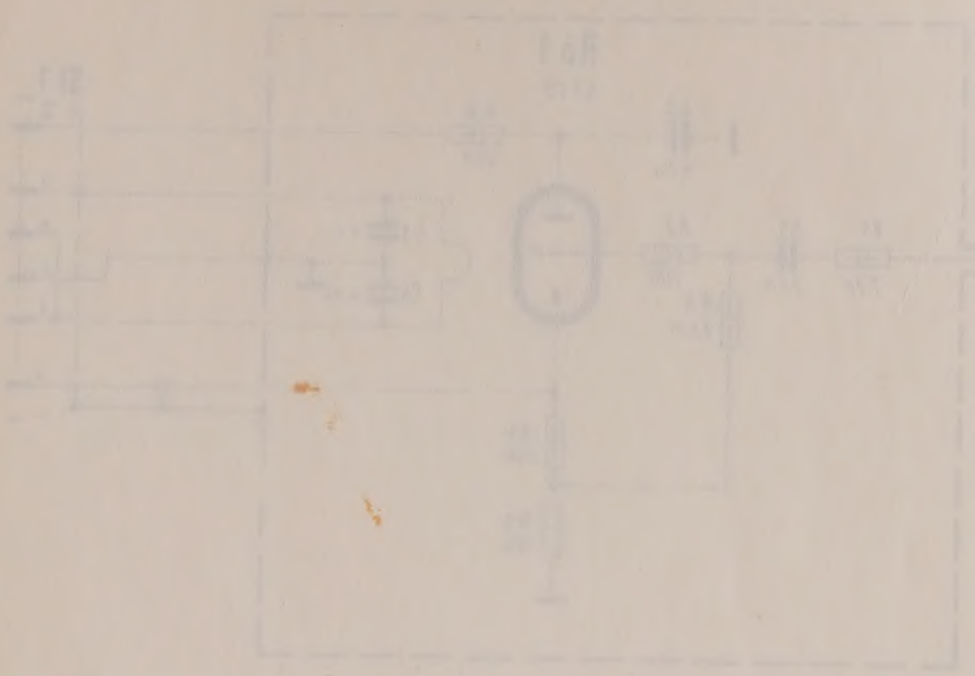
PROBE HEAD OF PROBE TK-2

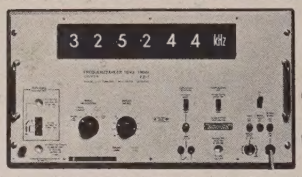
C 1	0,8...4,5 pF	1000 V		Trimmer
C 2	8 pF	125 V	± 20 %	Kf-Kondensator
C 3	47 pF	125 V	± 2,5 %	Kf-Kondensator

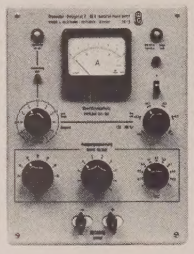


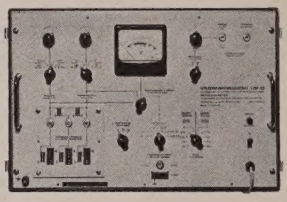
PROBE HEAD OF PROBE TK-3

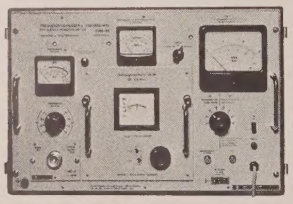
R 1	2,2 kΩ	0,1 W	5 %
R 2	200 Ω	0,05 W	± 10 %
R 3	1,5 MΩ	0,1 W	5 %
R 4	200 Ω	0,1 W	5 %
R 5	10 kΩ	0,5 W	5 %
R 6	200 Ω	0,1 W	5 %
C 1	25 nF	500 V	
C 2	4,7 nF	400 V	
C 3	4700 pF	250 V	+100/-20 %
C 4	4700 pF	250 V	+100/-20 %
Rö 1	Röhre	5718	Valvo

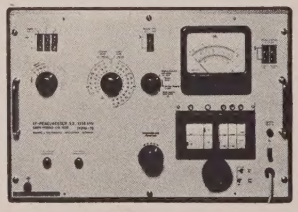


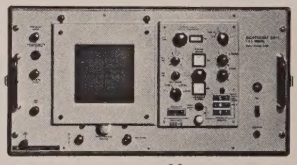












HIGH PRECISION ELECTRONIC MEASURING INSTRUMENTS

ALL OVER THE WORLD

MP MASTER
MA29294